

Notice of Allowability

Application No.

10/505,264

Examiner

Rip A. Lee

Applicant(s)

MINAMI ET AL.

Art Unit

1713

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to July 19, 2007.
2. ☒ The allowed claim(s) is/are 1-7, 9 and 13.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413), Paper No./Mail Date _____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____ | 7. <input type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____. |

Allowable Subject Matter

The following is an examiner's statement of reasons for allowance: Claims 1-7, 9, and 13 are allowed over the closest references cited below.

The present invention is drawn to a process for producing a high-fluidity 1-butene based polymer comprising homopolymerizing 1-butene, or copolymerizing 1-butene with ethylene and/or a C₃ or C₂₀ α -olefin except for 1-butene, in the presence of a polymerization catalyst comprising (A) a transition metal compound represented by general formula (II) and (B) at least one component selected from the group consisting of (B-1) a compound capable of forming an ionic complex by reacting with said transition metal compound (A), and (B-2) aluminoxane.

Another aspect of the invention is drawn to a process for producing a high-fluidity 1-butene based polymer satisfying the requirements: (1) intrinsic viscosity $[\eta]$ of 0.01 to 0.5 dL/g (tetralin, 135 °C), (2) melting point (T_m -D) of 0 to 100 °C, and (3) stereoregularity index $(mmmm)/(mmrr + rmmr)$ of 30 or lower, comprising homopolymerizing 1-butene, or copolymerizing 1-butene with ethylene and/or a C₃ or C₂₀ α -olefin except for 1-butene, in the presence of a polymerization catalyst comprising (A) a transition metal compound represented by general formula (II) and (B) at least one component selected from the group consisting of (B-1) a compound capable of forming an ionic complex by reacting with said transition metal compound (A), and (B-2) aluminoxane.

A third aspect of the invention is drawn to a process for producing a high-fluidity 1-butene based polymer satisfying the requirements: (1) intrinsic viscosity $[\eta]$ of 0.01 to 0.5 dL/g (tetralin, 135 °C), (2) melting point (T_m -D) of 0 to 100 °C, and (3) mesopentad fraction $mmmm$ of 68 to 73 %, comprising homopolymerizing 1-butene, or copolymerizing 1-butene with ethylene and/or a C₃ or C₂₀ α -olefin except for 1-butene, in the presence of a polymerization catalyst comprising (A) a transition metal compound represented by general formula (II) and (B) at least one component selected from the group consisting of (B-1) a compound capable of forming an ionic complex by reacting with said transition metal compound (A), and (B-2) aluminoxane.

The salient feature of transition metal complex (II) include: the carbocyclic ligand set is one in which substituents R^6 and R^7 and substituents R^8 and R^9 are bonded to each other to form a ring, cyclopentadienyl moieties of the carbocyclic ligand set are bridged in a (1,2')(2,1') fashion by bridging groups A^1 and A^2 , and bridging groups A^1 and A^2 are the same or different and are independently a C_1 - C_{20} halogen containing hydrocarbon group, or a silicon containing group, *inter alia*.

See claims for full details.

According to the present specification, the term "1-butene based" refers to polybutene homopolymer, as indicated in the process claims, or a (random) butene copolymer in which the content of structural units derived from 1-butene in the copolymer is 50 mole % or higher, and more preferably, 70 mole % or higher. Inventors further teach that where the content of structural units derived from 1-butene in the copolymer is less than 50 mole %, the resultant copolymer tends to be deteriorated; see specification, page 13.

Minami *et al.* (WO 99/67303; equivalent document U.S. 6,906,155) teaches a process for making propylenic polymer in the presence of a catalyst comprising a doubly bridged, *bisindenyl* ligand set having (1,2')(2,1') silylene/silylene connectivity. The patent teaches use of catalyst for preparing propylenic polymer which is a propylene homopolymer or a copolymer of propylene with ethylene and/or C_4 - C_{20} α -olefin. The amount of co-monomer is less than about 10 wt %. In one example, propylene polymer containing 0.9 wt % of butene comonomer is prepared in the presence of a catalyst comprising (1,2'- Me_2Si)(2,1'- Me_2Si) Ind_2ZrCl_2 . This polymer has an intrinsic viscosity of 1.2 dL/g. In another example, essentially the same catalyst is used to prepare a propylene polymer containing 9 wt % of butene comonomer that exhibits an intrinsic viscosity of 2.2 dL/g. It appears that propylene polymers containing increasing amounts of 1-butene comonomer exhibit higher values of intrinsic viscosity. Clearly, the prior art of Minami *et al.* does not teach or make obvious the subject matter of the instant claims.

Minami *et al.* (U.S. 6,414,090) teaches a process of making polymers of α -olefins having four or more carbon atoms in the presence of a catalyst containing transition metal complex having a doubly bridged, *bisindenyl* ligand set. The reference discloses use of (1,1')(2,2') alkylene/silylene, (1,1')(2,2') alkylene/alkylene, and (1,1')(2,2') silylene/silylene bridging combinations, but there is no teaching of use of (1,2')(2,1') bridging geometry.

Minami *et al.* (WO 99/09098 ; equivalent document U.S. 6,562,886) discloses a propylene copolymer containing not less than 80 mole % of units derived from propylene and 0-20 mole % of units derived from ethylene and/or C₄₋₂₀ α -olefin and having an intrinsic viscosity in the range of 0.5-5.0 dL/g. Another aspect of the invention is a polymer containing at most 0.5 mole % of ethylene and/or C₄₋₂₀ α -olefin and having an intrinsic viscosity in the range of 0.01-1.0 dL/g. These polymers are not prepared according to the process described in the instant claims.

Yabunouchi *et al.* (WO 0509172; equivalent document U.S. 5,854,165) discloses a process for preparing polymer in the presence of a catalyst comprising a doubly bridged transition metal complex component containing a (1,1')(2,2') alkylene/silylene, a (1,2')(2,1') alkylene/silylene, or a (1,2')(2,1') alkylene/alkylene bridging geometry. There is no teaching of use of catalyst comprising a transition metal complex containing a (1,2')(2,1') silylene/silylene bridging groups as required by the instant claims.

Kahsiwamura *et al.* (WO 96/30380 ; equivalent document U.S. 6,339,135) discloses preparation of olefin polymer in the presence of a catalyst comprising a doubly bridged transition metal complex component containing a (1,1')(2,2') or (1,2')(2,1') alkylene/alkylene bridging groups. There is no teaching of use of catalyst comprising a transition metal complex containing a (1,2')(2,1') silylene/silylene bridging groups as required by the instant claims.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."


Art Unit: 1713

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rip A. Lee whose telephone number is (571)272-1104. The examiner can be reached on Monday through Friday from 9:00 AM - 5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu, can be reached at (571)272-1114. The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <<http://pair-direct.uspto.gov>>. Should you have questions on the access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

ral

July 24, 2007


DAVID W. WU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700